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REVIEWS

Mineral Deposits of the Santa Rita and Patagonia Mountains, Arizona. By FRANK C. SCHRADER, with contributions by JAMES M. HILL. U.S. Geol. Survey, Bull. 582, 1915. Pp. 373, pls. 25.

This report covers an area of some 1,400 square miles extending north and east from the city of Nogales, Arizona, on the Mexican border. The mountain groups are short, irregular ranges bordered by broad, sloping plains of Quaternary gravels. Mesozoic granite, quartz diorite, and quartz monzonite, granite porphyry and aplite, with Tertiary andesite, rhyolite, and bedded tuffs and agglomerates, constitute the two groups of igneous rocks which outcrop over about two-thirds of the mountainous area. The remaining third is occupied by a thick sequence of Cretaceous (?) shales unconformably underlain by Carboniferous and Devonian limestones and older shales and quartzites.

The chief mineralization in this area accompanied or followed the Mesozoic intrusions. Silver, copper, gold, and lead are the leading metals. Fissure veins, contact-metamorphic deposits, replacement deposits, and gold placers are all of notable importance. Copper is the most important metal in the contact deposits, while silver and lead dominate in the replacement type, which is here rather carefully distinguished from the contact deposits proper. The average depth of ground-water level and of the oxide zone is about 250 feet.

C. W. T.

Some Mining Districts in Northeastern California and Northwestern Nevada. By JAMES M. HILL. U.S. Geol. Survey, Bull. 594, 1915. Pp. 196, pls. 12.

This is a report on a reconnaissance of nineteen widely scattered mining districts below first rank in present-day importance, sixteen of them in Nevada and three in California The chief value of the work will be to those who are specially interested in the development of one or more of these districts, though a number of points of general interest in economic geology are brought out.

Gold-silver, silver-lead, copper, and antimony deposits are described. Two epochs of mineralization are recognized, the first following the intrusion of a group of granitoid rocks in late Cretaceous or early Tertiary time, the second following the extrusion of a group of later Tertiary andesites and rhyolites. Most of the ores are believed to date from the former epoch. The gold-silver and silver-lead ores are vein deposits. Most of the copper ores are replacements of sedimentary rocks in the vicinity of monzonitic intrusives.

A number of good examples of magmatic differentiation are described.

C. W. T.

"A Geologic Reconnaissance of the Cuzco Valley, Peru." By HERBERT E. GREGORY. *Am. Jour. Sci.*, XLI (1916), pp. 1–100, pls. 2, figs. 44. Contributions from the Peruvian Expedition of 1912 under the Auspices of Yale University and the National Geographic Society.

The bottom of Cuzco Valley ranges from 10,000 to 11,000 feet above the sea. The higher peaks of its bordering ranges reach heights of from 14,000 to nearly 16,000 feet. Between 13,000 and 13,500 feet above the sea, there is a well-defined plateau surface, called by Gregory the "Inca peneplain." It is characterized by much gentler slopes than those of the deep canyons which have been incised into it by the present streams. It is underlain for the most part by complexly folded and faulted sedimentary rocks. Quaternary glaciation molded all of this region above 13,500 feet, and occasional moraines descend to 12,500 feet.

The Cuzco Basin, occupying the upper end of the valley, is about ten miles long by three miles wide. It is believed to owe its origin to faulting. It is floored with lacustrine sediments, probably of pre-glacial age, which are overlapped by large alluvial fans, now being dissected. At the head of the valley is a plateau surface sloping from 11,500 feet up to 13,000 feet above sea-level, underlain by Cretaceous limestones carrying marine fossils—the only marine sediments known in this region. The great bulk of the mountain masses surrounding the valley is made up of clastic sedimentary rocks: brown sandstones, chocolate shales, and conglomerates. These are divided by Gregory into three formations, one of which is composed chiefly of pyroclastic material. They are tentatively assigned to the Permian and Jura-Trias. There